



RIR CEC WORKSHOP

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Assessment of Northern California Sub-Regional Renewable Transmission Integration Priorities Beyond 2010

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Core Analysis Team:

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LLNL: Dora Yen-Nakafuji

SMUD: Craig Cameron, FOUNG Mua, Joe Tarantino

PG&E: Kang Ling Ching, Chifong Thomas

TANC: Larry Gilbertson, Brian Griess, Dave Larsen, Monte Meredith

WAPA: Phil Sanchez, Kirk Sornborger, Larry Tobias





Agenda

1. Objective of study
2. Base case development
3. Generator injection analysis
4. Scenario development
5. Transmission options
6. Power flow results
7. Conclusions





CA Integration Challenges

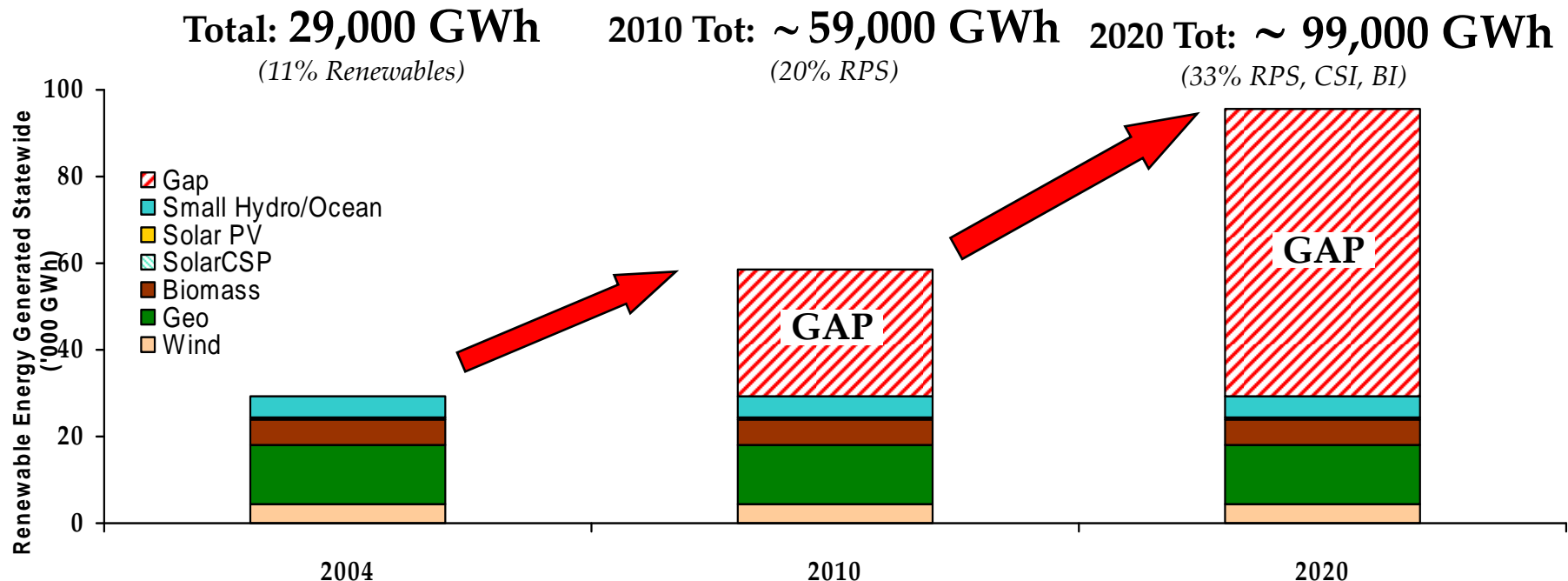
Policy, Market & Technology Drivers

- **Policy:** RPS and accelerated Goals for 2010 and 2020 targets
- **Market:** *Wind and geothermal* resources are anticipated to be the largest contributors to meeting the RPS (kWh)
- **Transmission Grid:** System & operational changes to accommodate higher levels of renewables
 - Resource planning (infrastructure, models)
 - System reliability (regulation, load following, reserves, ramping)
 - Control & dispatch (process, tools)



Motivation: Projected RPS Needs

Projected Renewables to Meet California Policy Goals



Data Sources: 2004, CEC Electricity Report which includes all renewables in the State, not just IOUs; 2010 and 2020, PIER Renewables Projections.

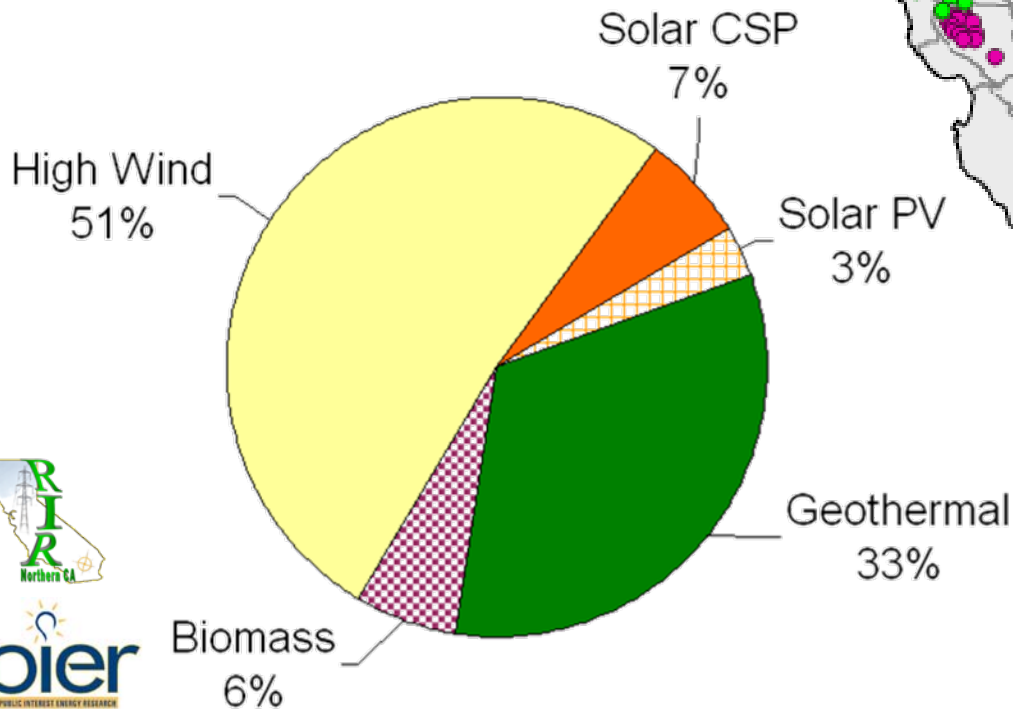
2010 Scenario

- 20% renewable generation
- Portfolio mix of resources
- 3000 MW of wind at Tehachapi

INJECTION LOCATIONS

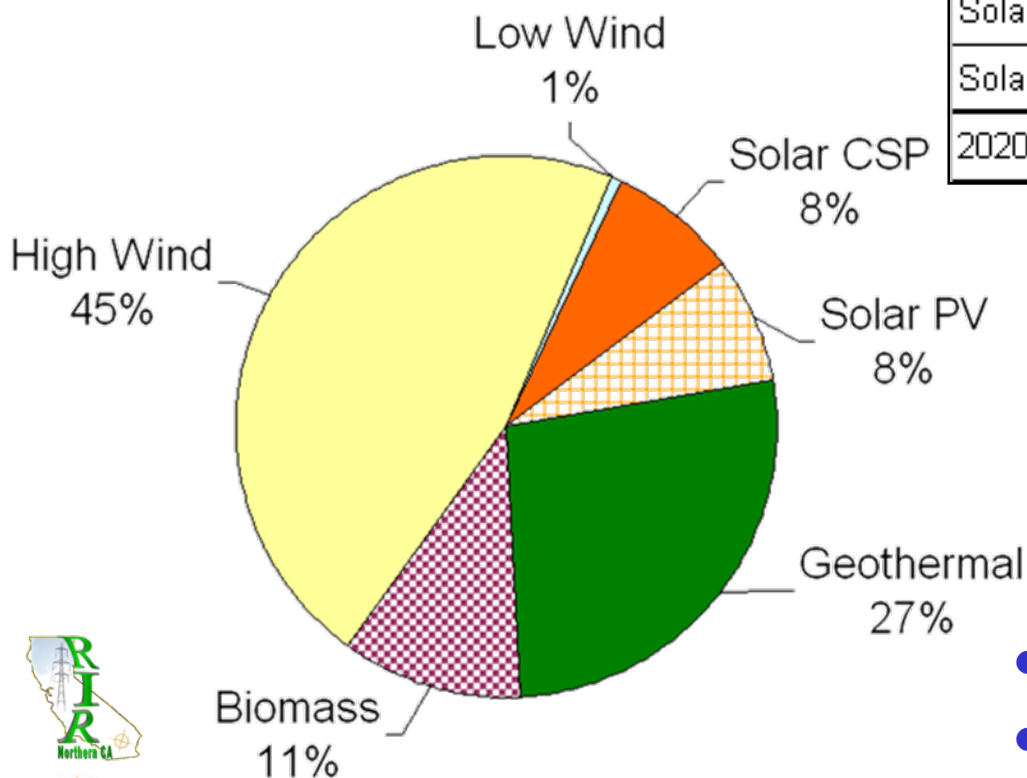
- Geothermal
- High Wind
- Distributed Biomass
- Solar CSP
- Solar PV

**Addition of
7,319 MW
29,000 GWh
to 2006
baseline**



2020 Scenario

Technology	MW	CF%	Energy (GWh)
Geothermal	2,385	90%	18,803
Biomass	980	84%	7,669
High Wind	9,961	37%	32,286
Low Wind	181	25%	396
Solar CSP	2,650	27%	5,442
Solar PV	3,000	20%	5,256
2020 Net Add-on	19,157		69,852



**Addition of
19,157 MW
69,852 GWh
to 2006
baseline**

- 33% renewable generation
- Portfolio mix of resources





Statewide Objectives

- Focus on statewide transmission planning options to help meet policy objectives
- Focus on providing quantitative impacts (pros & cons) of various options on transmission reliability, congestions and mix of renewable technologies
- Develop tools and analysis methods to evaluate renewables along with conventional generation
- Provide a common perspective for evaluating different technologies competing for limited system resources
- Provide a common forum for Commissions, utilities and developers to examine the location and timing of new generation/transmission projects and public benefits of these resources

RIR - A Piece of the Puzzle



- A number of existing transmission planning & renewable integration activities within state, WECC and nation
(e.g. CalSO, Tehachapi, Imperial, SVA, IAP utility studies)
- Require coordinated national, state and industry effort to find a “fitting” solution



Objective

- ❑ Proactively facilitate planning the transmission system to support customer loads
 - in advance of availability of specific resource information and
 - beyond the confines of single transmission owners in Northern California for 2015 - 2020 and beyond.





RIR - Structure

- ❑ Project Advisory Committee (PAC)
 - All Interested Stakeholders
 - monthly conference calls
 - Public workshops

- ❑ Core Analysis Team (CAT)
 - CEC: Michael Kane, Angela Tanghetti
 - CPUC: Brian Schumacher, Jesse Ante, Bob Elliott
 - CAISO: Gary DeShazo
 - LLNL: Dora Yen-Nakafuji
 - SMUD: Craig Cameron, Fong Mua, Joe Tarantino
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RIR - General Concept

- Laying a solid technical basis for Renewable Integration
 - Conceptual transmission
 - System reliability across multi-utility service areas
 - Preliminary route and engineering studies for cost estimates
- Will not cover:
 - Contractual issues
 - Cost Allocation
 - Commercial arrangement





Vision (Flexible Options) for Long-term Transmission for California

- ❑ Reliably serve Load
- ❑ Lowest possible cost to Customers in an environmentally responsible manner
- ❑ Enhance Market Efficiency, reduce Congestion where cost effective
- ❑ Connect Renewable Resources
- ❑ Maintain flexibility in developing transmission plans
- ❑ Address GHG & planning retirements of older units





Study Data & Technical Information

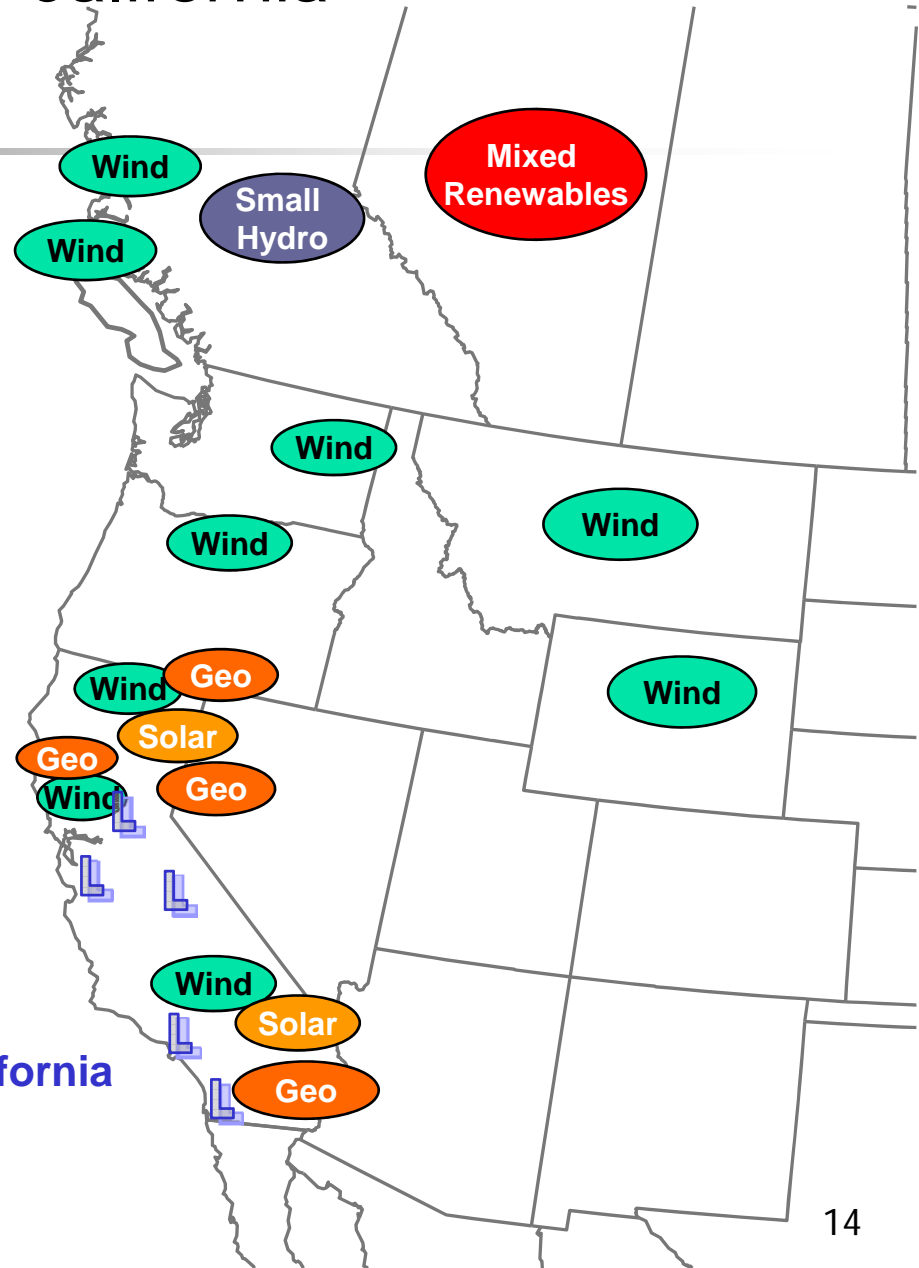
- ❑ Network Topology and Load
 - Based on latest available WECC and CAISO base cases
 - Renewable resource locations
- ❑ Resources information
 - CEC Reports & other Statewide, Regional & Local studies
 - Stakeholder Input



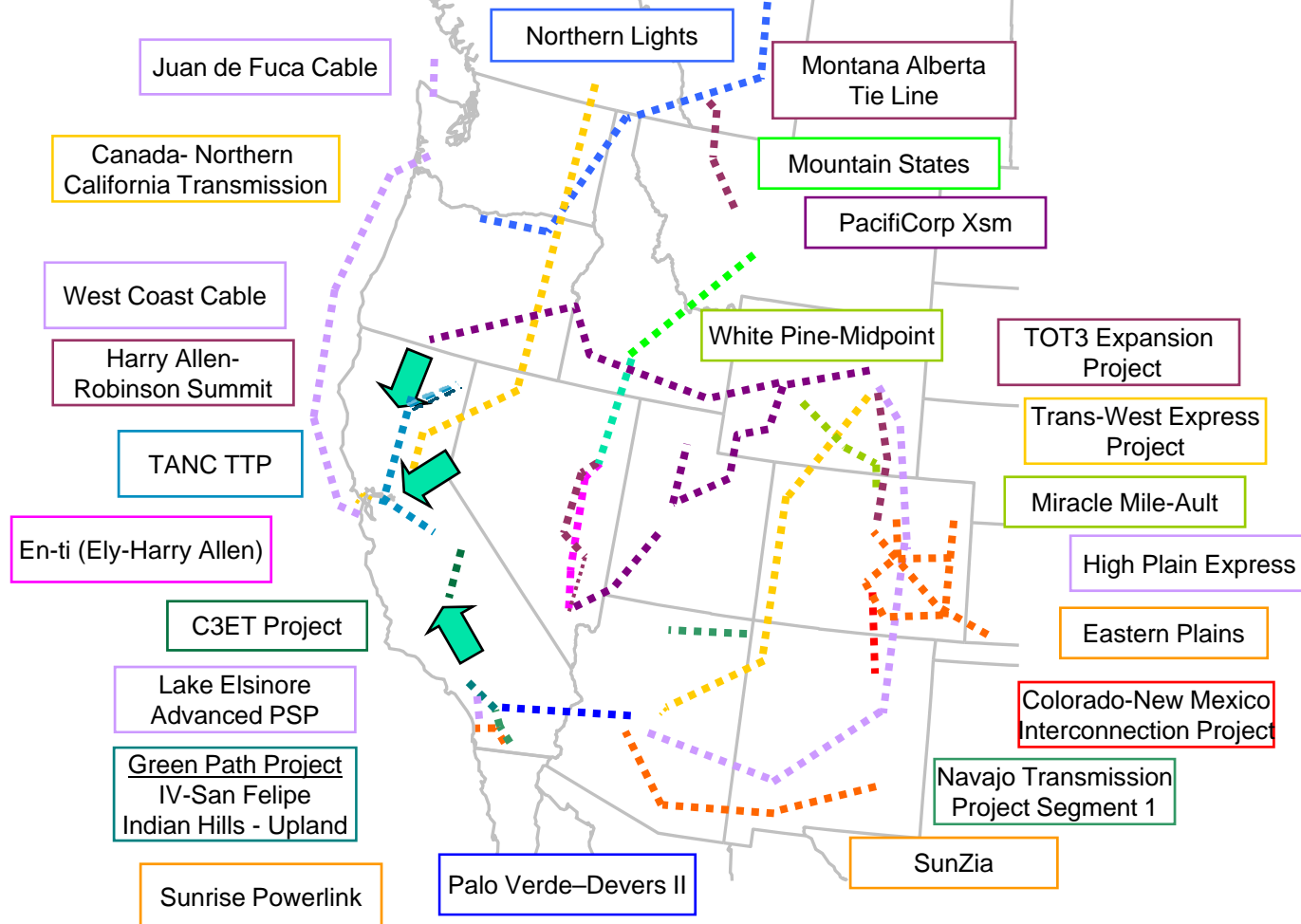
Potential Renewable Resources in WECC and Major Load Centers in California

- Alberta mixed Renewables
- B.C. Wind and Small Hydro
- Geysers Geothermal
- Mojave Solar
- Montana Wind
- N.E. California, Oregon, Nevada Geothermal and Wind
- Pacific NW Wind
- Salton Sea Geothermal
- Solano County Wind
- Tehachapi Wind
- Wyoming Wind

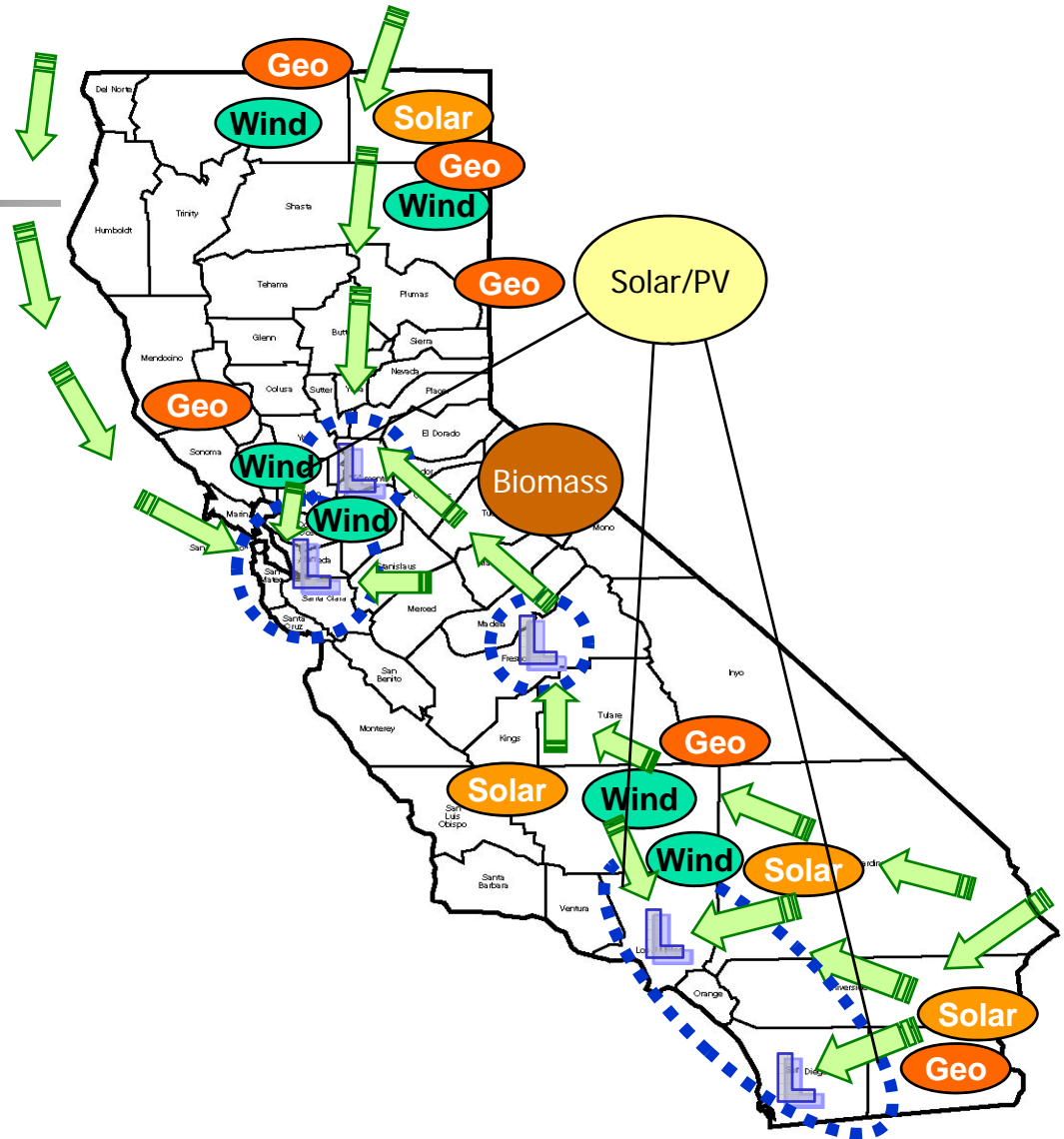
 -- Major Load Centers in California



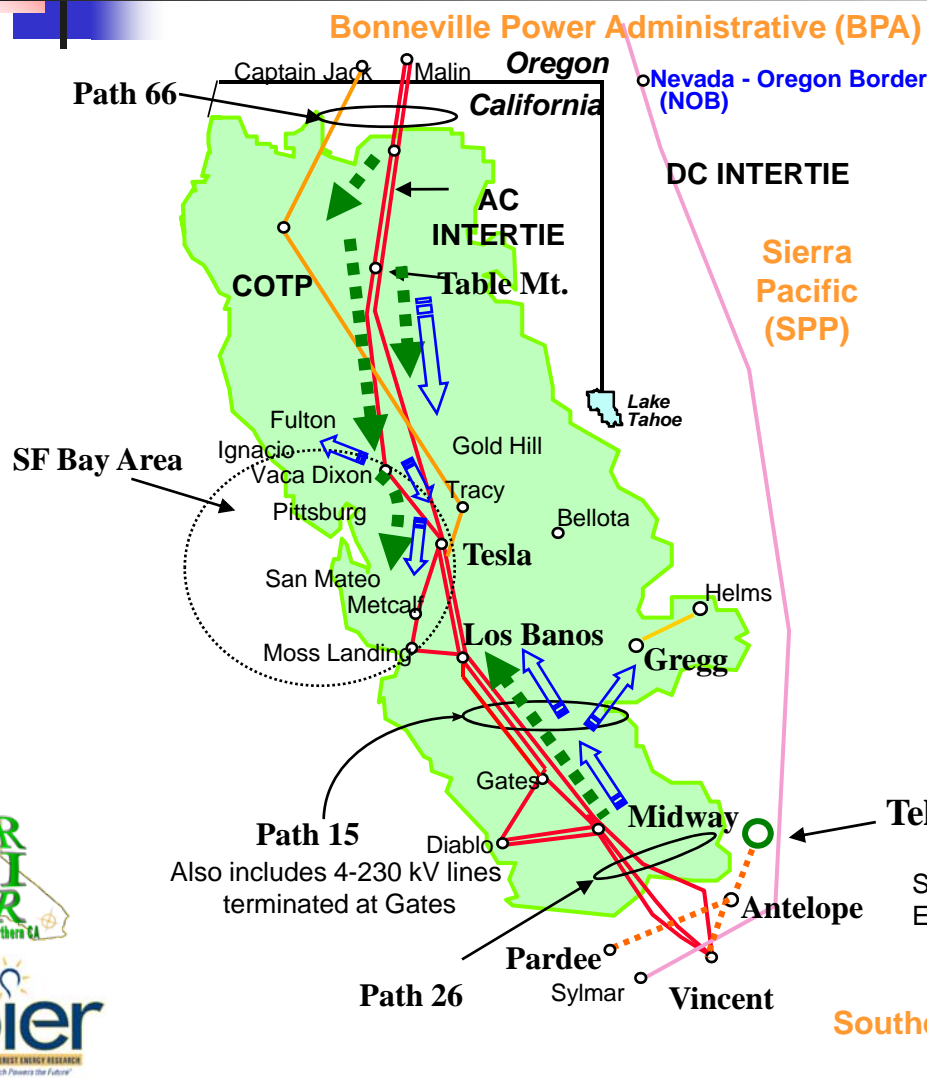
Transmission under Consideration in WECC => Potential impacts on N CA System



Possible Future Transmission Corridors in California



Promoting Multi-purpose Transmission Projects to Reduce Customer Risk/Increase Customer Benefits



Existing Path Ratings

	North-to-South (MW)	South-to-North (MW)
Path 66	4,800	3,675
Path 15	3,265	5,400
Path 26	4,000	3,000

- Corridors identified in Transmission Expansion Plan
- Corridors identified in Transmission Ranking Cost Report

SCE's Tehachapi Phase 1 Projects + Further Expansion depending on study





Proposed Methodology

- ❑ Develop resource scenarios based on sound transmission planning principles to supply projected demand in California based on information available (i.e. CalSO, CEC, other transmission working groups and the WECC for 2015 - 2020 and beyond)
- ❑ Develop transmission planning base cases covering peak (summer) and off-peak (winter) and other seasons as necessary (light spring).
- ❑ Develop transmission options for each resource scenario to supply projected load
- ❑ Analyze each option using transmission planning programs to develop conceptual transmission upgrades
- ❑ Identify the transmission upgrades that are common to more than two resource scenarios



Proposed Methodology - continued

- ❑ Run sensitivity with projected load increased and decreased by X%
- ❑ Consider impact of varying climate conditions if applicable (i.e. hydro variation, carbon footprint reductions)
- ❑ Develop reconnaissance-level cost estimates for each transmission upgrade
- ❑ Rank the transmission upgrades based on:
 - Its estimated cost
 - Its ability to support the most economic scenarios
 - Its ability to support large number of resource scenarios
- ❑ Develop preferred ranking of transmission upgrades

